APPLICATION FOR UNITED STATES PATENT

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INVENTION: Modular Block Assembly for Tufting Machine

SPECIFICATION

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MODULAR BLOCK ASSEMBLY FOR TUFTING MACHINE

FIELD OF THE INVENTION

[0001] The present invention relates to a tufting machine with replaceable self-aligning gauge modules and is more particularly concerned with a gauge module with individually replaceable gauge elements which can be readily installed and removed.

BACKGROUND OF THE INVENTION

[0002] Tufting machines are built with precision so that the needles and loopers of the machine are accurately spaced from each other along the needle bar or looper bars. The loopers and needles must be spaced from each other so that the looper bills pass closely adjacent to the needles to engage and hold loops of yarns carried by the needles. When assembling a tufting apparatus, errors in positioning these gauge elements may accumulate as the work progresses. The present invention seeks to establish consistency with these parts across the width of the apparatus, to provide a tufting environment, suitable even for narrow gauge configurations. The present invention also addresses the problem of replacing individual gauge elements that become broken or damaged during tufting. In most modular designs, a broken gauge element requires discarding the entire modular block containing a set of about one to two dozen gauge

elements. The present invention allows for quick and efficient replacement of individually damaged gauge elements.

[0003] The idea of replacing individual components of assemblies in tufting machines is not new. In the past, knife holder assemblies have been devised that allow for the replacement of individual knives. The knives were arranged in pre-assembled or modular fashion in a knife holder, each knife holder having a guide mechanism which enables the knives, as a group, to be positioned on a carrying member of a tufting machine and maintained in appropriate alignment. U.S. Pat. Nos. 4,608,934; 4,669,171; 4,691,646; and 4,693,191 illustrate such prior art knife holder assemblies in which parallel knives are disposed in juxtaposition in guide bars which are provided with guides for guiding and then clamping them in appropriate positions on a tufting machine.

[0004] Needles have previously been individually secured in modular gauge blocks as shown in U.S. Patent No. 4,170,949, and hooks and knives have also been individually secured in gauge parts mounting blocks as shown in U.S. Patent No. 4,491,078. These designs have used individual clamping screws to hold each gauge element in place. These blocks were not mated with slots on the carrying members and were heavily machined.

[0005] More recently attempts have been made to incorporate needles and loopers into replaceable modular

assemblies. U.S. Pat. Nos. RE37,108, 5,896,821, 5,295,450 illustrate such modular gauge assemblies in which the gauge elements are permanently embedded into the modular block. The block is attached to the guide bar with a single screw allowing for removal and replacement of the block. One shortcoming of these modular assemblies is that when a single gauge element breaks the entire modular assembly must be discarded.

SUMMARY OF THE INVENTION

[0006] The present invention includes a modular gauge assembly that attaches to a gauge bar. The gauge bar has a plurality of positioning recesses that allows a detent on an individual modular block to be accurately positioned along the gauge bar. Each modular block typically includes a front surface, a pair of side surfaces opposed to each other, a rear surface opposite to the front surface, and a bottom surface. A tongue, which may or may not be a part of the cast block extends from a bottom or bottom surface of the modular block. The tongue includes a threaded hole which along with a securing screw serves to mount the block to a gauge bar. The threaded hole aligns with the gauge bar receiving hole when the tongue of the modular block is positioned properly with a recess on the gauge bar. When sufficiently tightened, the securing screw holds the modular block to the gauge bar. At least the front surface contains a plurality of spaced parallel slots so that gauge elements may be

positioned in the slots with proper spacing in the block. The proximal ends of the gauge elements have apertures recessed therein. The proximal ends of the gauge elements are inserted into the block and secured there by a securing pin that enters the block on one of the opposing side surfaces and passes through the apertures on the proximal ends of the gauge elements. Individual gauge elements can be replaced by demounting the affected block, removing the securing pin and removing the selected gauge element. After the selected gauge element is removed a new gauge element may be re-inserted into the proper vertical slot and secured by the securing pin.

[0007] A plurality of modular blocks are arranged along the surface of the gauge bar and are vertically positioned on the gauge bar by a horizontal surface on the gauge bar or on a guide bar that passes through a guide bar channel on the gauge bar. The width of each block is equal to the distance between the positioning recesses of the gauge bar so that the edges of the blocks abut one another and the blocks are laterally positioned.

[0008] In an alternative embodiment of the present invention the modular gauge assembly attaches to a gauge bar having a plurality of positioning recesses that allows the detent on an individual modular block to laterally position the block on the gauge bar. Each modular block typically includes a front surface, a pair of side surfaces opposed to each other, a rear

surface opposite to the front surface, and opposing bottom and top surfaces. The rear surface contains a rectangular tab or detent that includes a threaded hole to receive a securing screw. The threaded hole aligns with the gauge bar receiving hole when the modular block is positioned properly on the gauge bar. When tightened, the securing screw holds the modular block securely to the gauge bar. A plurality of gauge holes extend from the bottom toward the top surface, in some cases passing through the modular block. Gauge elements with proximal ends adopted to be received within the gauge holes may be positioned with proper spacing in the block. Gauge elements that have the proximal end inserted into the block are securely positioned pin-screws that enter the block below the tab on the rear surface. The pin-screws are positioned beneath the tab. In this fashion, the pin-screws can be accessed without removing the modular block from the gauge bar.

[0009] Accordingly, it is an object of the present invention to provide a tufting machine where the gauge elements of the tufting machine are accurately positioned within a modular block assembly.

[0010] Another object of the present invention is to provide in a tufting machine, a system which can facilitate the rapid change over of one or more damaged gauge elements, reducing to a minimum the downtime of the tufting machine.

[0011] Another object of the present invention is to provide in a modular block assembly, a system which can facilitate the rapid change over of individual damaged gauge elements, reducing the cost of repairing broken gauge elements and removing the need to replace entire modular blocks when a single gauge element becomes damaged.

[0012] Other objects, features, and advantages of the present invention will become apparent from the following description when considered in conjunction with the accompanying drawing wherein like characters of reference designate corresponding parts throughout several views.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Figure 1 is a fragmentary perspective view of a modular block assembly with single looper modular blocks in place on a gauge bar.

[0014] Figure 2 is an exploded perspective view of modular block assembly of Figure 1 with modular blocks removed from the gauge bar, and one single looper modular block disassembled.

[0015] Figure 3 is a perspective view of the rear surface of a modular block of Figure 1.

[0016] Figure 4 is a fragmentary perspective view of a double looper modular block assembly with the modular blocks in place or the gauge bar.

[0017] Figure 5 is an exploded perspective view of the modular block assembly of Figure 4, with modular blocks removed from the gauge bar and one block disassembled.

[0018] Figure 6 is a fragmentary perspective view of a modular needle block assembly with the modular blocks in place on a gauge bar.

[0019] Figure 7 is an exploded fragmentary perspective view of the modular needle block assembly of Figure 6 with the modular blocks removed from the gauge bar and one block disassembled.

[0020] Figure 8 is a rear perspective view of a modular block of Figure 6.

DETAILED DESCRIPTION

[0021] The present invention is utilized in a tufting machine of the type generally including a needle bar carrying one or more rows of longitudinally spaced needles and which is supported and reciprocally driven by a plurality of push rods. In the tufting zone, the needles carry yarns which are driven through a backing fabric by the reciprocation of the needles. While penetrating the backing fabric, a plurality of longitudinally spaced hooks cooperate with the needles to seize loops of yarns and thereby form the face of a resulting fabric. In some cases the hooks will cooperate with knives to cut the loops of yarn seized on the hooks and thereby form a cut pile face for the fabric. The present invention is directed to

modular units for holding loopers or hooks and for holding needles to facilitate their cooperation during the tufting process.

[0022] Referring in detail to Figure 1, a modular block assembly **5** is illustrated having a single row of gauge elements **10**, in this case loopers, housed in the modular blocks **15**. The individual gauge elements **10** are fastened to the block **15** by securing pin **20**. As better illustrated in Figure 2, the securing pin **20** enters the modular block **15** at one of the opposing side surfaces **22a**, **22b**. The gauge bar **25** and guide bar **30** are used in concert to position the individual modular blocks **15** relative to one another. The guide bar **30** slides laterally through channel **35** substantially the entire length of the gauge bar **25**, and engages tab breaks **115** of the modular blocks **15**, as shown in Figure 3, to vertically align the individual blocks **15**.

[0023] Figure 2 illustrates a portion of the modular block assembly **5** with the blocks **15** detached from the gauge bar **25**. The gauge bar **25** has a plurality of vertical recesses **40**. The recesses **40** are crossed by lateral channel **35** so that guide bar **30** fits between the gauge bar **25** and the rear surfaces **45** of the modular blocks **15**. Guide bar **30** creates upper face **31** and lower face **32** which are normal to the side walls of recesses **40**.

Theses faces **31**, **32** serve as restraining surfaces. One modular block **15** in Figure 2 is disassembled and removed from the gauge bar **25** to reveal the spaced parallel slots **50** divided by vertical walls **51** located on the front surface **55** of the block for receiving the proximal ends **75** of the gauge element **10**. The proximal ends **75** of the gauge elements **10** contain apertures such as pin holes **70**. When the gauge elements **10** are positioned in the modular block **15**, the pinholes **70** align with apertures formed in side surfaces of the block such as pin opening **85**. Securing pin **20** is then inserted through the pin opening **85** in one of the opposing side surfaces **22a**, **22b**, and the pin opening **85** for each gauge element **10** to fasten the gauge elements **10** to the block **15**. In modular blocks **15** containing only a single row of gauge elements **10**, a tongue portion **60** extends from the rear surface **45** of the modular block **15**. The tongue **60** forms the detent. The tongue **60** has an opening **90**, as shown in Figure 3, preferably in the form of a threaded hole which aligns with another hole **100**, located in a gauge bar recess **40**, when the modular block **15** is positioned on the gauge bar **25**. Once a modular block **15** is positioned a securing screw **65** can be inserted through the opening **90** and tightened into the hole **100** on the gauge bar. A modular block **15**, once fixed in place by the securing screw **65**,

is prevented from lateral and vertical movement. The screw **65** and vertical recesses **40** resist against horizontal movement while the screw and faces **31,32** of the guide bar **25** resist against vertical movement. The fixed position of the blocks **15** insures that the gauge elements **10** remain properly aligned during the tufting process.

[0024] Figure 3 shows the rear surface **45** of a modular block **15** having a single row of gauge elements **10**. On the rear surface **45** is an elongated tab **110** that extends vertically from the top **165** of the block to the bottom of the tongue portion **60** of the block. The tab **110** has a horizontal break **115** which as previously described engages with guide bar **30** to vertically position block **15** on the gauge bar **25**. The walls of break **115** are preferably substantially planar and parallel so that a part of the rectangular cross section of guide bar **30** closely fits within the break. The lower segment of the tab **120** contains the opening **90** where the securing screw **65** enters and attaches to a receiving hole **100** in the gauge bar.

[0025] Figure 4 illustrates a modular block assembly **5** having three double gauge element modular blocks **130** mounted on the gauge bar **26**. Each modular block **130** contains two gauge element rows **125**. Modular blocks **130** have two apertures such as

pin openings **85a**, **85b** that are spaced apart on the side surfaces **22a**, **22b** of the block **130**. Unlike single gauge element blocks **15**, a portion of the double gauge modular blocks **130** rests on top of the gauge bar **26** to vertically position blocks **130**. This is accomplished by pushing the tongue **60** forward to the center of the bottom of the block **135**.

[0026] Figure 5 shows an exploded view of modular block **130** containing two rows **125** of gauge elements **11, 12**. The gauge bar **26** in Figure 5 has a plurality of vertical recesses **40**. Vertical recesses **40** receive tongues **60** to horizontally position blocks **130** along the gauge bar **25**. Vertical positioning is accomplished by resting part of the bottom surface of gauge blocks **130** on the top surface of gauge bar **25**. The modular block **130** in Figure 5 is disassembled and removed from the gauge bar **26** to reveal the spaced parallel slots **50a**, **50b** located on the front **55** and rear surface **45** of the block **130** for receiving the proximal ends **75, 78** of the gauge elements **11, 12**. The proximal ends **77, 78** of the gauge elements **11, 12** contain openings such as pin holes **71, 72** which when positioned in slots **50a, 50b** of modular block **130** align with pin openings **85a** or **85b**, respectively. The securing pins **20a, 20b** are inserted through the pin openings **85a** or **85b** on one of the opposing side surfaces

22a, 22b and through pin holes 71, 72 for each gauge element 11, 12 to fasten the gauge elements 11, 12 to the modular block 130. In the illustrated modular blocks 130 containing two rows 125 of gauge elements 11, 12 the tongue portion 60 of the modular block 130 extends from the center of the bottom surface 135. The tongue 60 defines an opening 90 (not shown) which aligns with receiving holes 100, located in the vertical recesses 40, when the modular block 130 is positioned on the gauge bar 26. Once the modular block 130 is positioned a securing screw 65 can be inserted through opening 90 and tightened into a threaded receiving hole 100. The modular block 130, once fixed in place by the securing screw 65, is prevented from lateral and vertical movement. The fixed position of the block 130 insures that the gauge elements 10 remain properly aligned during the tufting process.

[0027] Referring now to Figure 6, another aspect of the present invention depicts a modular block assembly 5 having a single row of gauge elements, in this case needles 13, housed in a clamping modular block 140. Figure 6 shows four clamping modular blocks 140 attached to the gauge bar 27. The clamping modular blocks 140 are positioned such that the lower portion 150 of the block 140 extends beneath the gauge bar 27. This exposed

lower portion **150** contains the individual clamping elements, such as screw-pins **145**, shown in Figure 7, that hold the gauge elements **13** in place in the block **140**. The gauge bar **127** has a horizontal shelf portion **27a** and a vertical portion **27b** which join to form an interior right angle.

[0028] Figure 7 illustrates a portion of a modular block assembly **5** with screw-pin modular blocks **140** detached from the gauge bar **25** and one block **140** disassembled. The gauge bar **27** has a plurality of vertical recesses **40** imposed on the front of the gauge bar **27**. As illustrated, the recesses **40** do not extend the entire height of the wall portion **27b** of the gauge bar **27**. Each recess contains a preferably threaded hole **100** which receives a securing screw **65** to attach the block **140** to the gauge bar **27**. The rear surface of the modular block **45** contains a rectangular tab **160** having an opening **90**, shown in Figure 8, which aligns with the hole **100**, located in the gauge bar vertical recesses **40**. Once the modular block **140** is positioned in the right angle between the shelf portion **27a** and wall portion **27b**, with tab **160** received in a vertical recess **40**, the securing screw **65** can be inserted through the corresponding hole **100** in the wall portion **27b** into the opening **90** in the rectangular tab **160** and tightened to hold the modular block **140** in place. Once fixed in

place by securing screw **65**, the modular block **140** is prevented from lateral movement by the action of the tab **160** fitting with the walls of the vertical recess **40**, the screw **65**, and adjacent blocks **140**. Horizontal movement is restored by action of the screw **65** at the bottom of shelf portion **27a** of the gauge bar **27**. The fixed position of the block **140** insures that the gauge elements **10** remain properly aligned during the tufting process.

[0029] Figure 7 also depicts a disassembled clamping modular block **140** thereby revealing the spaced parallel gauge element openings **155** which extend from the top surface **165** to the bottom surface **135** of the block **140**. Openings **155** need not extend completely to the top surface **165** for satisfactory operation, however, it is convenient for manufacture. The individual needles **13** are fastened to the block **140** by dedicated clamps such as screw-pins **145** that fix individual gauge elements **10** within the block **140**. Screw pins **145** enter the block **140** at the rear surface **45** of the block **45** on its lower portion **150**. When the block is attached to the gauge bar **25** the screw-pins **145** remain accessible so that individual gauge elements **10** can be removed and replaced.

[0030] Figure 8 illustrates the top **165** and rear surface **45** of the block **140**. Gauge element openings **155** can be seen on

the top surface **165** of the block **140**. The rectangular tab **160** for positioning the block **140** on the gauge bar **25** is located centrally on the rear surface **45** of the block **140**. The rectangular tab **160** defines the opening **90** which aligns with the holes **100** in vertical recesses **40** and with securing screw **65** fixes the block **140** to the gauge bar **27**. Openings **170** for screw pins **145** are located horizontally along the lower portion **150** of block **140**.

[0031] Although a preferred embodiment of the present invention has been disclosed in detail herein, it will be understood that various substitutions and modifications may be made to the disclosed embodiment described herein without departing from the scope and spirit of the present invention as recited in the appended claims.